# An Address

ON

# THE HISTORY AND NATURE OF CERTAIN SPECIMENS ALLEGED TO HAVE BEEN OBTAINED AT THE POST-MORTEM EXAMINATION OF NAPOLEON THE GREAT.*

(WITH SPECIAL PLATE.)

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ON May 5th it wil be ninety-two years since the great Napoleon died. The physicians who attended him during his exile in St. Helena from October 17th, 1815, until the stormy evening of May 5th, 1821—O'Meara, Stokoe, Antommarchi, Arnott—are all dead long ago. We cannot question them now concerning the Emperor's symptoms and mortal disease. We must form our opinion of the nature of his illness from the letters they wrote and the diaries which they kept. So minutely have these documents been studied and their reliability discussed, that the verdict pronounced by modern writers such as Lord Rosebery [1] and by M. Paul Frémeaux [2] carries with it an air of finality. Their verdict is (1) that in his last illness Napoleon was attended by a series of incompetent physicians, who formed a wrong opinion of the case and applied disastrous remedies; (2) that Napoleon died of cancer of the stomach, the Emperor himself being the only one to form an approximately accurate diagnosis.† It seems scarcely possible at this distance of time that any new evidence bearing on Napoleon's last illness can be in existence, yet I hope to convince you that the two small specimens from the Museum of the Royal College of Surgeons of England are actually parts of the great Emperor's body, and that they throw a new light on the "drama of St. Helena."

In the history of these specimens John Hunter, the patron saint of this society, is indirectly connected. They have been preserved on the shelves of the museum founded by him; they came to that museum through one of the most famous of Hunter's pupils—Sir Astley Cooper—the dominant surgeon in England at the time of Napoleon's death. They came to Sir Astley Cooper from Napoleon's physician, O'Meara, who had good reason to remember Hunter's existence, for in 1823, when living in the Edgware Road, London, O'Meara married the aged widow of Captain Donellan, whom Hunter tried to save from the hangman's rope in 1781. Soon after Antommarchi took up his post at St. Helena, in succession to his friend O'Meara, Napoleon questioned him regarding the inheritance of disease, fearing then (November, 1819) that he suffered from the malignant condition which carried off his father at the early age of 39—cancer of the stomach. The authority quoted by Antommarchi to convince his august patient that disease is not inherited was John Hnnter. "Hunter," said Antommarchi,[4] "one of the greatest physicians England has produced, was the first to combat that theory (the inheritance of disease), and all the schools have adopted his ideas on the subject" (vol. i, p. 237). A thin thread of Hunter thus runs through the story of Napoleon's last illness.

Before proceeding to relate the history and prove the authenticity of the Napoleonic documents now brought before you, it will be well to give first a brief account of their appearance and nature. They are two small pieces of the human bowel suspended in sealed bottles filled with alcohol. A superficial observer might easily believe that he is looking at two small oblong tags of dusky skin, each with a curious wart-like raised patch in its centre (Figs. 1 and 2). The largest of the specimens could be covered by six postage stamps; it measures 55 mm. long by 35 mm. wide; the smaller measures 48 by 25 mm. The expert, however, observes that the two surfaces of the specimen are totally different in texture and appearance. One side is covered by the inner or mucous lining of the bowel; this lining membrane is here and there raised up into transverse folds, so shallow and slight that one infers with certainty that the specimens have been cut from the lower part of the small intestine—the ileum. The wart-like plaques are really elevated areas set within the lining membrane of the bowel, and in life it is clear they must have been situated on the free side of the bowel—on the opposite side to that which is attached to the suspending membrane or mesentery of the bowel. While one side of the specimen is thus covered by a shaggy mucous lining, the other, or outer, is smooth, being composed of the peritoneal and muscular coats of the bowel. Even on the outer or smooth surface the wart-like growth on the inner surface is apparent; its outline comes through as a blackish patch or spot (see Fig. 3), but, since the wart-like growth contains some effused blood and dilated vessels, these patches at the *post-mortem* examination must have shown out on the free surface of the bowel as red patches, and must have then been sufficiently prominent to catch the eye of the anatomist. These two small tags of bowel seem very slight documents to throw light on the old and vexed questions relating to Napoleon's death, but they have the advantage over all other available documents that they are facts for all time, whereas diaries and letters are but imperfect reflections of what man's brain believed at one time to be facts.

I shall now proceed to lay before you a series of documents which will explain why this source of evidence has been neglected during these seventy years past. The first document is from the pathological catalogue of the Museum of the Royal College of Surgeons; it was written by Sir James Paget when he was revising a new edition of the catalogue in 1883 and represents the mature opinion of the foremost of surgeon-pathologists of the Victorian period.

No. 2526. A portion of small intestine with a raised, rounded plaque of cancer projecting about one-eighth of an inch above the mucous membrane, and five-eighths of an inch in diameter; its surface is broken and fissured, and its edges overlap the mucous membrane around its base of attachment.

No. 2527. Another portion of small intestine, with a much smaller oval cancerous nodule having a smooth rounded surface.

This and the preceding were in the Museum of Sir Astley Cooper.

The following entry is in the MS. Catalogue of Sir Astley Cooper's Museum.

> "Incipient Fungus in the Glands of an Intestine Napoleon. Barry O'Meara to Sir Astley Cooper."

The truth of the statement that these portions of intestine were taken from the body of the Emperor Napoleon I is open to grave doubt. Dr. Antommarchi, Napoleon's personal physician, states, in his very complete account of the *post-mortem* examination, that "the mucous membrane of this canal (intestinal) appeared to be in a sound state"; and in the separate report, drawn up by the English surgeons present at the autopsy, the statement is found that, with the exception of the stomach, "the abdominal viscera were in a healthy condition." It further appears from Dr. Barry O'Meara's memoir (*Napoleon in Exile*, etc.) that he was recalled to England nearly three years before Napoleon's death; and the steps taken by Napoleon's personal attendants to prevent the abstraction of the heart and stomach also show the improbability of these specimens having had the source ascribed to them.—October, 1883.

It is very clear that Sir James Paget did not believe that these specimens represent parts of Napoleon's body. His reasons may be summarized thus: (1) No mention is made of similar appearances in the *post-mortem* report; (2) O'Meara was in England when Napoleon died; (3) Napoleon's body was closely guarded, so that abstraction of parts was impossible.

The next document I produce is from M. Paul Frémeaux, who is rightly regarded as the highest authority in everything pertaining to Napoleon. The letter was addressed to the editor of the *Daily Mail*, and it is by his courtesy that I am enabled to publish it now.

Sir,—The *Daily Mail* has published on 12th of February last (1910) a very favourable review of *The Drama of St. Helena*, the English translation of *Les Derniers Jours de l'Empereur*, which had just come out in London. A few days later, on the 18th, my



* Second Hunterian Lecture of the Hunterian Society; delivered January 8th, 1913.

† After this lecture was prepared for publication, M. H. Barlow called my attention to a work just published, *The Illness and Death of Napoleon Bonaparte*, by Dr. Arnold Chaplin (Hirschfeld Bros., 1913). Dr. Chaplin does not accept the specimens here described as authentic, and regards the Emperor's death as due to cancer of the stomach secondary to an ulcer of the stomach. See also BRITISH MEDICAL JOURNAL, December 28th, 1912, p. 1761.

name and book were again kindly alluded to in your columns. I feel so much indebted to the *Daily Mail* that I beg to be allowed to elucidate for its readers, if I can, the question you have raised as to the authenticity of a Napoleonic relic preserved at the Royal College of Surgeons. "There," according to your statement, "in a small upper room, are two bottles, each containing a section of intestinal membrane. The label says: *Two portions of small intestine with cancerous growths projecting above the mucous membrane. They came from the museum of Sir Astley Cooper, with the following description: Incipient fungus in the glands of an intestine. Napoleon. Barry O'Meara to Sir Astley Cooper. It is almost certain that these specimens were not taken from the body of Napoleon.*" The label does wisely, I think, in expressing such a doubt. To realize this it is only necessary to examine two points. First, is it possible that any part of the Emperor's corpse can ever have been abstracted and have become an anatomical relic? Be it said at once that it is possible, but highly improbable. Secondly, admitting that portions of intestine were ever abstracted from the Emperor's corpse, can the specimens in the museum of the Royal College of Surgeons be those portions? This time the answer will be No!!! it is not possible.

Napoleon expired on the evening of the 5th of May, 1821. His autopsy took place on the following day, the 6th of May, at 2 p.m., as related in *The Drama of St. Helena*. The work of dissection was undertaken in a green painted and crudely lighted room of Longwood House by the Emperor's own physician, Dr. Antommarchi, under the eyes of five English Surgeons, the Doctors Short, Arnott, Mitchell, Burton and Livingstone, and of two assistant surgeons, Doctors Rutledge and Henry. Lieutenant-Colonel Thomas Reade, Major Harrison and Captain Crokat represented the Governor, Sir Hudson Lowe; Grand Marshal Bertrand, Count de Montholon, and the Abbé Vignali, the French Colony at St. Helena. Three servants of Napoleon, Marchand, St. Denis, and Picheron, who had brought in the corpse and laid it on a large table covered with a sheet, were also present.

Dr. Antommarchi opened the body.

The cavity of the thorax was first exposed to view, and the lungs and the heart detached from it; the liver, the stomach, and the intestines were next taken out of the abdomen. When the several organs had been duly examined, they were, with the exception of the heart, which was to be offered to the ex-Empress Marie Louise, and of the stomach, which had been found the seat of the mortal disease, restored to their places, and still under the eyes of all the spectators, the closing of the body by means of a suture was made by Dr. Antommarchi.

Napoleon's remains were then dressed for interment in the uniform of a colonel of Chasseurs of the Old Guard, and Assistant Surgeon Rutledge was ordered to take charge of them. He has left a memorandum of his watch in which he says: "The heart and stomach were put in a silver case by me, and I was directed by Sir Thomas Reade not to lose sight of the body or the vase, to take care and not to permit of the cavities being opened a second time for the purpose of the removal of any part of the body, and not to allow the contents of the vase to be disturbed without an order from him to that effect. . . ."

On the evening of the seventh, Dr. Rutledge saw the corpse and the vase containing the stomach and the heart, placed and soldered up in a leaden coffin, and on the ninth, Napoleon was carried to his grave in Geranium Valley.

This short account is sufficient to show, I think, how unlikely is the supposition that any part of Napoleon's body may have been clandestinely removed, either during the process of autopsy, or later on, during Dr. Rutledge's watch. During the autopsy, the abstraction could hardly have escaped the notice of a rather numerous party; during Dr. Rutledge's watch, the complicity of this surgeon would have been required in order to commit a most criminal and a most downright sacrilege—the undressing and secret reopening of the corpse.

But, admitting, as I said before, the possibility of portions of the small intestines having been taken from the body of Napoleon, the specimens on view at the Royal College of Surgeons and described as infected with incipient fungus, cannot be those identical portions. The impossibility is clearly shown by the *post-mortem* observations made on the 6th of May at St. Helena. There exist two reports of the autopsy: an official report established by Drs. Short, Arnott, Mitchell, Burton, and Livingstone, and the private report of Antommarchi. According to the official report, the only abdominal viscera presenting unhealthy appearances were the liver, which suffered from abnormal adhesions, and the stomach, which was perforated by an ulcer and had become a mere mass of cancerous disease. In the private report of Antommarchi, where the state of all the organs is described at fuller lengh, it is a question of the intestines, but the remark made on them is "that the *large* intestines were covered with a substance of a blackish colour and extremely viscous." This blackish substance must have been simply an exudation of matter coming from the stomach; for in a note written to Count de Montholon previous to his report, Antommarchi says that:—"all the intestines were sound." Dr. Henry, who was, as it has been seen, one of the persons present at the autopsy, states also, in an unpublished letter to Sir Hudson Lowe I have in my possession, that the intestines were in a healthy condition.

The Napoleonic relic on view to the public at the Royal College of Surgeons is consequently a more than dubious one. The distinguished Curator of this Museum, Dr. Keith, interviewed by one of your representatives, pointed out to him that a man of the social standing and medical reputation of Sir Astley Cooper, who was President of the College of Surgeons in 1827, and at one time made £30,000 a year in fees, would hardly have left the statement inscribed on the label above referred to unless he had been convinced of the genuineness of the specimen. But this statement does not seem indeed as explicit as it ought to be for such an exceptional specimen. Instead of "Incipient fungus in the glands of an intestine: Napoleon," one would like a somewhat longer and more precise mention, such for instance, as: "Incipient fungus in the glands of an intestine: two affected portions of small intestine *taken from the body of Napoleon*." Further, is it not surprising that Sir Astley Cooper did not take the trouble to write out and commit to some separate and special paper a full story of so precious an anatomical relic, and to tell among other things, how Barry O'Meara, who was not at St. Helena at the time of the Emperor's death, had been able to procure it? If the divulgation would present, about 1840, any danger for anybody, nothing was so easy for Sir Astley as to state that the paper would be kept sealed up and remain secret for a given number of years after this date.

The reasons which led M. Frémeaux to reject the specimens before you as authentic Napoleonic relics are Paget's reasons amplified and emphasized. When I produce the third document, by my esteemed colleague Mr. Shattock, Pathological Curator of the College of Surgeons' Museum, you will have lost faith both in the specimens and in myself. Sir Astley Cooper described the intestine as showing incipient fungus, which, in our terms, may be translated as an early stage of cancer; Sir James Paget unhesitatingly said the intestinal outgrowths were "rounded plaques of cancer." Soon after Sir James Paget wrote the description printed above, Sir Frederic Eve,* when acting as Pathological Curator to the Museum, examined sections of the outgrowths under the microscope—a method unused in diagnosis until long after Napoleon's time—and found they were not cancerous in nature. There the matter rested until recently, when a part was cut from each tumour, and a continuous series of sections were cut, stained by various methods to bring out the nature of the tissues, and examined microscopically. The results of that examination will be seen in Mr. Shattock's report, which is as follows:

### DESCRIPTION OF SPECIAL PLATE.

Fig. 1.—The larger piece of bowel, showing the plaque-like outgrowth on the surface of the mucous coat. (From a photograph; natural size.)

Fig. 2.—The same specimen viewed on its peritoneal or outer surface. The plaque-like growth is also apparent on this surface; the serous coat over it is frayed and ragged. (Natural size.)

Fig. 3.—The second piece of bowel with a similar but smaller outgrowth in the mucous coat. (Natural size.)

(Figs. 1, 2, and 3 are from blocks prepared by Mr. Frank Butterworth for new edition of the Guide to the Museum of the College.)

Fig. 4.—Section across the edge of the larger plaque (Fig. 1), showing its relation to the coats of the bowel. The mucous coat ascends on the edge of the plaque but ceases there. The lymphoid tissue comes to the surface and is breaking down, especially towards the centre. The submucous coat splits at the edge of the plaque so as to enclose the cellular mass. Strands derived from the submucous coat (represented by black lines) are seen to be scattered in the mass, as in a Peyer's patch. The inner or circular muscular coat is very thin and beneath the plaque becomes partially opened out by intrusions of the small round-celled tissue. The outer longitudinal and serous coats have become detached from the inner circular coat—a rupture which may have been caused during manipulation of the specimen. (Magnification × 20.)

Fig. 5.—Section across the edge of the smaller plaque. The same coats are seen as in Fig. 4; the lymphoid mass is enclosed in the submucous coat. The mucous coat passes on to the summit. Ulceration seen in the last is absent. There is no infiltration of the inner muscular coat. (Magnification × 20.)

#### HISTOLOGICAL REPORT UPON SECTIONS OF THE TWO INTESTINAL LESIONS STATED TO HAVE BEEN OBTAINED FROM THE BODY OF NAPOLEON I.

April, 1910.

I.

The *smaller* lesion, the edge only of which was histologically examined, is a somewhat prominent hemi-

* Mr. Shattock and I were unaware of Sir Frederic Eve's examination until after our own investigations were completed. It will be thus seen that two independent examinations have been made.

PROFESSOR A. KEITH: ON CERTAIN SPECIMENS ALLEGED TO HAVE BEEN OBTAINED AT THE POST-MORTEM EXAMINATION OF NAPOLEON THE GREAT.

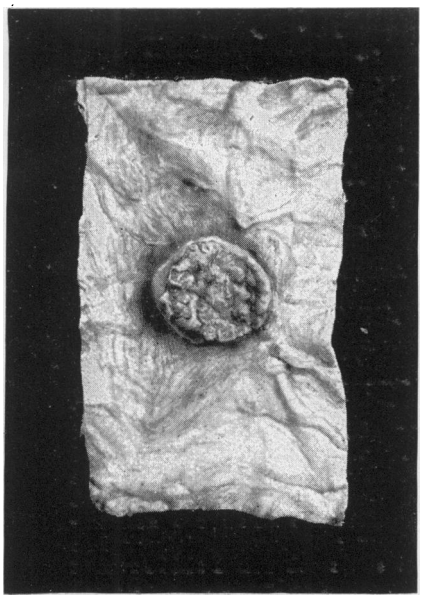

FIG. 1.

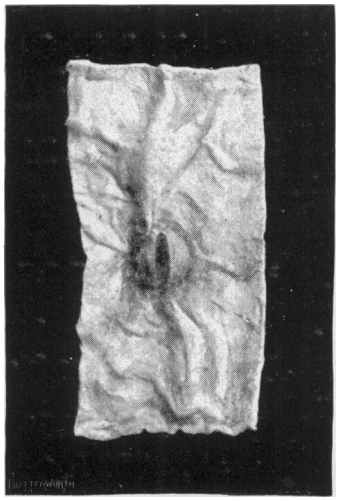

FIG. 3.

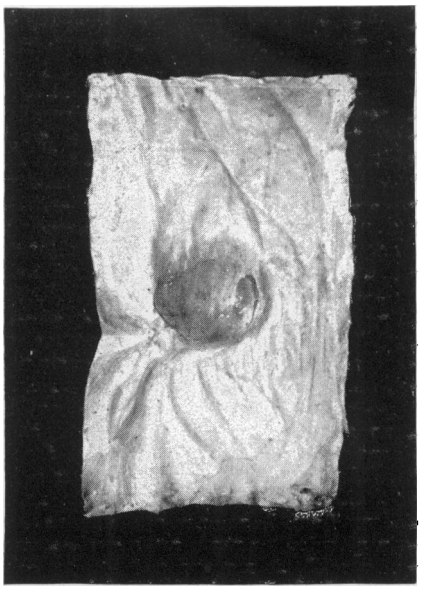

FIG. 2.

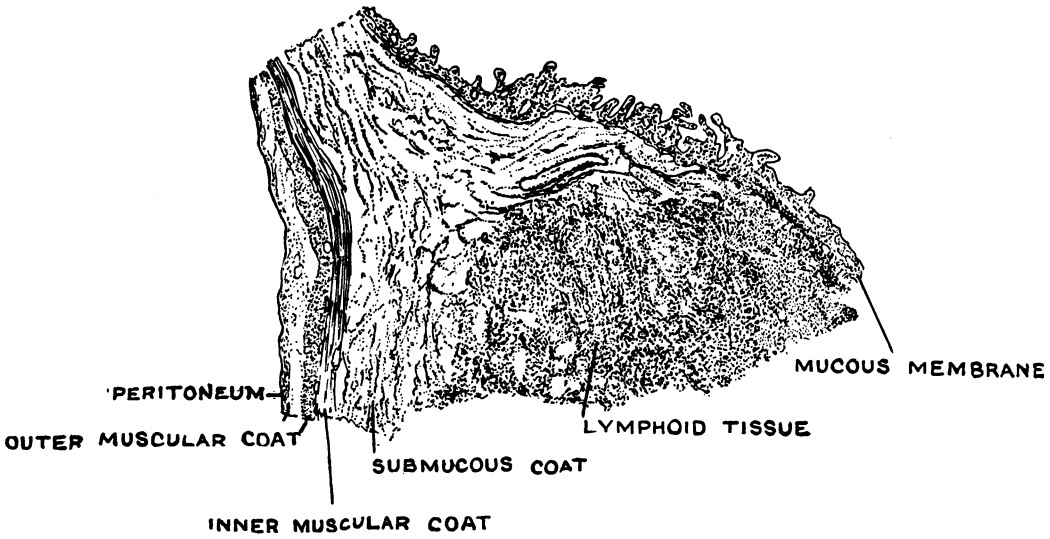


FIG. 5.


FIG. 4.

spherical eminence 6 mm. in diameter, overhanging its base of attachment, and projecting from the mucosa into the lumen of the bowel, the outer surface of which is smooth and flat.

The sections include portion of the normal intestine beyond the eminence, and were cut vertically to the free surface; they were stained by Van Giesen's method. Although the several histological elements have stained with very little differentiation (with the exception of the fibrous tissue), the general structure is readily traceable; the glandular epithelium is fairly preserved, and the columnar form of the individual cells, patches of which remain in certain of the crypts, is quite distinct, although the nuclei are undifferentiated.

In the unaffected portion of intestine beyond the lesion the several coats are easily to be recognized; the villi are intact, but their investing epithelium is wanting. Over the edge of the swelling the villi are likewise entire; there is no ulceration or necrosis. The swelling itself is confined to the submucosa, and is sharply limited both laterally and on the deep aspect. It consists of small cells lying in a stroma of connective tissue.

There are in it certain denser collections or blocks which at first suggest an epithelial origin, but these do not lie in proper alveoli of their own, but in the midst of the other tissue; and all gradations between such and the general mass of cells occur. In no instance are such collections furnished with a lumen (which in the crypts is well pronounced), and in none can they be resolved into columnar cells, although in the proper crypts such cells are quite distinct.

The examination of a second series of sections, made so as to include the whole extent of the lesion, shows that the nodule is strictly confined to the submucous tissue, that it is circumscribed, and that it consists of a uniform collection of cells supported in the meshes of a somewhat scanty stroma of connective tissue. There is no indication of a second epithelial structure in its midst.

Although badly preserved and in consequence indifferently stained, the mass can, under one-sixth objective, be resolved in favourable spots into small round cells arranged in the meshes of a delicate stroma, the whole of the appearances corresponding with those of a "solitary gland."

In places the tissue is strewn with brownish pigment, as though it had been the seat of past haemorrhage.

II.

The larger lesion takes the form of a low, discoidal elevation, slightly overhanging its base, and measuring 15 mm. in diameter. The peritoneal surface of the gut is smooth and flat. The microscopic sections include the edge of the lesion, with the adjoining piece of the bowel.

The lesion is practically limited to the submucosa, and is sharply circumscribed both laterally and on its deep aspect. The deeper coats of the intestine are intact beneath it. The mucosa ceases over the summit of the eminence.

Structurally it consists of a uniform mass of small cells, with little stroma.

A considerable amount of brown, spheroidal pigment is scattered throughout the lesion, indicative of past haemorrhage.

*Remarks upon the Histological Data.*

There can be no doubt that the two lesions represent a solitary and an agminated gland of the lesser size.

Their limitation to the submucosa, their circumscription, and the extension of the mucosa over them all combine to show this. In form and size they resemble such glands when enlarged from inflammatory or hyperplastic conditions. There is no indication that either is the seat of a carcinomatous inroad from the epithelium.

Into both glands haemorrhage appears to have occurred.

In sections stained with Cresylecht violet the presence of bacteria, chiefly short, stout bacilli (probably *B. coli*), is very obvious.

S. G. SHATTOCK.

It will thus be seen that these pieces of bowel do not show secondary cancerous growths at all, but enlargements of those areas of lymphoid tissue which are normally present in the lower part of the small bowel, known as Peyer's patches, the use of which—be it spoken for our encouragement—we do not even yet know. We do know, however, that such patches become enlarged in many chronic diseases which are endemic in the tropics, and the clinical notes made by Napoleon's physicians leave not a shadow of doubt, as I shall show presently, that the Emperor suffered from a disease in which the lymphoid tissue of the body was subject to enlargement.

My faith that these specimens might prove genuine—at least, that their history was worth investigating—rested on my belief in Sir Astley Cooper. He had John Hunter's passion for collecting specimens, especially such as illustrated the diseases of distinguished patients. When a puzzling case had ended in death he summoned his assistant, Mr. Lewis, and addressed him thus: Mr. —— is dead; I must have an inspection of that tumour."[3] When the tumour was obtained a small label was attached, and it was dropped into a big tank with many others. Sir Astley, like all busy men, expected leisure days to come in the eve of his life when the specimens could be arranged, catalogued and described—but when the time came the will and desire had abated. Hence, when his collection—comprising 1,500 specimens—was acquired by the Royal College of Surgeons after his death in 1841, at the age of 73, my predecessor, Mr. Clift, reported to the Council of the College that Sir Astley had attached only the bricfest of descriptions to his specimens, and that full histories could be obtained only by a search through his private papers—a search that was never carried out. Hence the description attached to the Napoleonic specimens—"*Napoleon, Barry O'Meara, to Sir Astley Cooper*"—is perfectly in order. Two preparations obtained at the *post-mortem* examination of royal personages have even briefer labels—merely the name of the distinguished patient and the date. There can be no doubt, then, that the two specimens were in the possession of Astley Cooper, and that he believed they were genuine, and, we may be certain, had good reason for this belief.

Sir Astley Cooper had peculiar opportunities of acquiring anything of particular medical interest. He was recognized as the leading, learned, and popular surgeon of his time. He was surgeon to King George IV and to King William IV. He was the trusted medical adviser of Lord Liverpool, the Tory Prime Minister during the exile, illness and death of Napoleon; he was well acquainted with Lord Bathurst, Secretary for War and for the Colonies, who had the care and keeping of Napoleon. He must have been consulted often by these two men about the Emperor's case. If any one in England could possibly command or obtain any first-hand evidence from the *post-mortem* examination, Sir Astley Cooper was that man. We know, too, he was an alert man of the world—a shrewd judge of men, and the very last person to deceive himself or to wilfully mislead others when in the quest of truth. Hence, when he attached the brief label to the Napoleonic relics we may be certain that he knew how O'Meara obtained them.

I have said that it was my faith in the judgement and honesty of Sir Astley Cooper that induced me to investigate the history of these specimens. It was a study of Antommarchi's account of the *post-mortem* examination which brought the conviction that they must be authentic. Paget and Frémeaux appeared to have overlooked the passage which I now quote from Antommarchi's report:

> The digestive canal was distended by a great quantity of gas. In the peritoneal surface and in the folds of peritoneum (mesentery) I observed small spots and patches of a pale red colour (petites taches et de petites plaques rouge, d'une nuance très légère) of various dimensions and scattered at some distance from each other. The mucous membrane of this canal *appeared to be* in a sound state. The large intestine (that is, its lining membrane) was covered by a blackish, very viscous matter.[4]

I have mentioned that the raised lymphoid plaques in the two Napoleonic specimens contain effused blood and dilated vessels. They must have appeared, therefore, as red patches scattered along the intestine, giving rise to the exact condition described by Antommarchi. We have to suppose, therefore, if these two specimens are not genuine, that O'Meara, having read Antommarchi's report, obtained by some miracle similar specimens from another *post-mortem* examination, and foisted them on a shrewd man like Sir Astley Cooper as genuine Napoleonic remains.

We have seen that Sir James Paget quotes the second sentence of the above extract from Antommarchi's report, "The mucous membrane appeared to be in a sound state." Could an intestine showing raised plaques be described as apparently in a sound state? The explanation is to be found in the conditions under which the *post-mortem* examination was carried out. In a modern *post-mortem* room with large sinks and ample supply of water the viscous matter which coated the lining membrane of the bowel could be thoroughly cleansed away and the plaques would then become apparent. But at Longwood there were neither sinks nor a sufficient supply of water; the lay representatives of Napoleon's staff and of Sir Hudson Lowe's establishment were looking on; a satisfactory cause of death had been discovered before the bowels came to be examined. Even if he had so desired, it would have been impossible for Antommarchi to carry out the tedious and disagreeable duty of examining the lining membrane of the bowel from end to end. That his examination was cursory is apparent from his words—"The mucous membrane *appeared to be* in a sound state."

The question may well be asked here: Why is it, then, that the official report, drawn up by the five medical officers who looked on while Antommarchi made the examination of Napoleon's body, contains no mention of these red spots and plaques on the intestine? The official report simply states that the stomach was the seat of an extensive cancer and that the rest of the body was healthy, except that the upper surface of the liver was bound to the dome of the diaphragm by adhesions. Every medical man knows that the official report cannot be true; a cancer so extensive as that of Napoleon's must have spread and there must have been secondary growths along the lymph streams leading from the stomach. That there were such secondary deposits we learn from Antommarchi's report. He records that:

> The gastro-hepatic omentum was contracted, swollen and very much hardened and broken down. The lymphatic glands in this fold of peritoneum and those situated along the curvatures of the stomach, as well as those situated over the pillars of the diaphragm were in part enlarged, scirrhous and some were even in a state of disruption. . . . Many of the glands of the air passages of the lungs (bronchiae) and in the space between the lungs (mediastinum) were somewhat enlarged, almost breaking down and undergoing suppuration. . . . The left lung was slightly compressed by a pleural effusion and had numerous strands of adhesion to the *posterior* and lateral parts of the chest and to the pericardium. I carefully dissected the lung and found the superior lobe strewn with tuberculae (nodular masses) and some small tuberculous excavations.

It is clear from Antommarchi's description that the cancer had spread, and that the appearances described by him are exactly those which we expect to find in the later stages of a case where death has resulted from cancer of the stomach. The English surgeons simply say "trifling adhesions of the left pleura were found; the lungs were quite sound." Why is it that we have to refer always to Antommarchi's account to obtain the details relating to the marks of disease in Napoleon's body? There are two reasons: (1) As I shall show, Antommarchi was a skilled anatomist and pathologist, trained under and assistant to Paul Mascagni, the very ablest anatomist and pathologist in Europe at the beginning of the nineteenth century; the English naval and army surgeons had no special training in such investigations. (2) The official report was a political, not a medical, document; it had to convince the opponents of Lord Liverpool's Government, the enemies of the Governor of St. Helena—Sir Hudson Lowe—and the partisans of Napoleon, that the Emperor died, not from a disease caused by his confinement in St. Helena, but by one which, at that time, was regarded as a dispensation of Providence. It is true that Antommarchi wished to prove that his patient had died from a "chronic gastro-hepatitis," but he sets the facts down which he observed as he made the examination, and they are twisted in no manner whatsoever to support the theory he was so desirous of proving—namely, that Napoleon was killed by his confinement in St. Helena. There is really only one report of Napoleon's *post-mortem* examination; that is Antommarchi's, and in that document we find described the appearances which agree with those to be seen in the two specimens preserved in the Museum of the Royal College of Surgeons.

We have thus traced the history of these specimens at two points in their history. We have Sir Astley Cooper's word for it that they came into the possession of Dr. Barry O'Meara. We have an authentic document showing that Antommarchi saw morbid appearances of the same kind as those shown by the two specimens when he performed the *post-mortem* examination on May 6th, 1821, twenty hours after the Emperor's death. Only Antommarchi thought them worth mention and therefore worth acquiring or investigating. How and why did they pass from Antommarchi to O'Meara? We shall see that neither the opportunity of acquiring them, the means of transferring them, nor a good reason why they should have been given by the Corsican to the Irishman are wanting.

Those two men being the centre figures of my story must be surveyed at close quarters and their movements and motives followed. Modern writers have formed a very indifferent opinion of them. Lord Rosebery[1] says of O'Meara: "Least of all, perhaps, to be depended on is O'Meara." And as to Antommarchi his lordship writes: "No one of the chroniclers is less reliable. . . . We must take the Antommarchian narrative for what it is worth, and that is very little." M. Frémeaux[2] says of him: "In spite of his incompetency, he succeeded at first in giving the impression of being a good doctor." As regards O'Meara, Colonel Knollys sums up his character thus (*Dict. Nat. Biography*): "There seems no doubt that his conduct throughout was that of an indiscreet person or rather a puppet of Napoleon. His diagnosis of his patient's case as one of liver disease, induced by the malignity of the climate, was falsified by Napoleon's subsequent death from a disease which is not affected by climate." O'Meara and Antommarchi, if we accept the verdicts just quoted, seem to be the very last persons on whom we can place any reliance. We shall see how far they deserve to be thus maligned.

When Napoleon stepped on board the *Bellerophon* on July 15th, 1815, O'Meara was one of the surgeons on board. The Emperor was in his forty-sixth year, the surgeon in his twenty-ninth; O'Meara's knowledge of the Italian tongue became a bond between them; the young Irishman of Trinity College, Dublin, was chosen to accompany the Emperor to St. Helena as personal medical attendant. His services were not seriously required until the summer of 1816, when the Emperor had his first attack of a peculiar fever which recurred again and again until death occurred on May 5th, 1821. The attacks were recurrent and lasted for irregular periods; their average duration was about three weeks; they were always most severe in the closing months of each year; they became more frequent and more severe as the case progressed. The attacks were ushered in by rigor, fever, and headache; usually the first symptoms of each onset was an attack of colic attended by diarrhoea or intestinal disturbance; usually the throat and air passages became inflamed and catarrhal; the gums became swollen, ulcerous, and bleeding. The tonsils enlarged; so did the lymphatic glands in the groin; we may safely infer that the lymphoid tissues of the whole body, including Peyer's patches in the intestine, were also involved. The feet and legs became swollen and remained swollen until the attack had passed away, leaving the Emperor weak in body and depressed in mind. In the attack at the close of 1816 no symptoms of a special affection of the liver were observed. During the attacks of fever which commenced towards the end of 1817, however, all the characteristic symptoms of an inflammatory condition of the liver became manifest, and in every recurring bout of fever these symptoms became more and more prominent. There is no kind of cancer of the stomach, nor of ulcer of the stomach, unless that ulcer is part of a general infection, that can give rise to such attacks of fever as Napoleon suffered from in the first three years of his illness. On the other hand, we do know that many forms of fever endemic to tropical countries may first attack the bowel, or enter the body by the bowel, and at a subsequent date give rise to disturbance or inflammation of the liver.

O'Meara formed the opinion—he could not have done otherwise—that Napoleon was suffering from a form of inflammation of the liver, or hepatitis, which is endemic to, and then prevalent in, St. Helena. It is very easy for

us now to see, with our modern knowledge of tropical diseases, that Napoleon was the unfortunate victim of a general infection—one affecting particularly the alimentary tract and secondarily the lymphoid tissues of the body—a form of infection in which the liver often becomes the seat of disease. No wonder if Napoleon did become infected with the diseases endemic to St. Helena; sources of infection abounded. Mosquitos buzzed round him; the water which he drank was carried from a distance and stored in open vessels. We know that some of the water sources of St. Helena were infected. In November, 1817, the convict ship *Friendship* came into the harbour of Jamestown, all on board being well on her arrival. She took water on board, and in ten days over 100 of the convicts were prostrate with attacks of diarrhoea and fever, similar to those which overtook Napoleon.* There were goats on the island, which, in the Mediterranean region at least, are the transmitters of Malta fever; rats also abounded at Longwood.

O'Meara's position in St. Helena was one of great difficulty; he had to serve two masters—Napoleon and the Governor, Sir Hudson Lowe. He stuck manfully by his patient, with the result that he was sent home on July 25th, 1818. On November 2nd of that year his name was ordered to be erased from the list of naval surgeons. He then settled in London, took up the cause of Queen Charlotte, and later became an ardent follower of O'Connell and an advocate of the first Reform Bill. In January, 1819, Napoleon was for three days in the medical charge of Surgeon Stokoe, of H.M.S. *Conqueror*. He saw Napoleon in one of the attacks of the recurrent fever, diagnosed inflammation of the liver with impending abscess. He was court-martialled and dismissed the navy. Sir Hudson Lowe had forbidden the diagnosis of any endemic disease of the liver—at least, in the island under his charge.

Before Antommarchi enters our narrative it will be well to again refer to the condition found in Napoleon's body after death. We have seen that the English surgeons admitted there was some pathological adhesions between the liver and the diaphragm. For fuller information we turn to Antommarchi's report:

> The spleen and liver were *indurated*, *enlarged*, and *distended* with blood. The texture of the liver, which was of a brownish-red colour, did not, however, exhibit any remarkable alteration in structure. The gall bladder was filled and distended with very thick and clotted bile. The liver, which was affected by chronic hepatitis,* closely adhered by its convex surface to the diaphragm; the adhesions occupied the whole extent of that organ, and were strong, cellular, and of old formation.

We see, then, that not only did Napoleon manifest in his illness all the symptoms which indicate an inflammatory infection of the liver, but that at his death the clearest evidence was found that the liver had been the seat of an inflammation so acute that the diseased tissue which had formed round the liver had become converted into tough bands of adhesion.† Yet O'Meara and Stokoe were dismissed from the navy by ignorant laymen because they were competent and truthful physicians. In Napoleon's case the presence of cancer was masked by the severity of the original disease, an endemic tropical fever, one of a family of diseases the nature and cause of which are only now becoming understood. It will also be perceived how anxious O'Meara must have been when the Emperor's death occurred to obtain some evidence that the diagnosis he made of the case was well founded and right. We shall see that Antommarchi had every reason to supply him with such evidence.

We now turn to Antommarchi, the much misunderstood Malvolio of the drama of St. Helena. At the time of O'Meara's dismissal, near the end of the summer of 1818, Antommarchi was in Florence attached to the hospital of St. Mary's as assistant or prosector in anatomy and pathology—the two subjects were not then separated. He was at that time a man of 29—three years younger than O'Meara—a Corsican by birth, a Frenchman by nationality, an Italian by education, and the most excitable mortal ever caged within the walls of a laboratory. In 1812 he became assistant to Mascagni; in 1815 that great master of anatomy died, leaving his magnificent illustrations and discoveries unpublished. In 1818 Antommarchi was busily preparing Mascagni's plates for publication, on behalf of a committee which had raised money for this purpose. O'Meara, on reaching England in 1818, dispatched two letters to Italy, one from Napoleon requesting "Madame Mère" to get him a physician, another giving a full description of Napoleon's case to guide the physician chosen as his successor at St. Helena. Cardinal Fesch chose two men—Abbé Vignali, a cleric, who had acquired a smattering of medicine, and Antommarchi, who, late in the autumn of 1818, sat in the dissecting room at Florence preparing Mascagni's plates for publication. The winter 1818–19 was spent in preparing to depart; in February, 1819, Antommarchi went to Rome, where Napoleon's case, as set out by O'Meara, was discussed at a sederunt of physicians. He reached London on April 19th, 1819, on his way to St. Helena; he left London on July 9th. During his stay of nearly three months in London he saw O'Meara almost every day, consulting and receiving advice about Napoleon's case. The Corsican had more in his head than Napoleon's case; he carried Mascagni's plates under his arm, and showed them to everybody and everywhere. At first the authorities refused him permission to take these plates to St. Helena; they suspected that these drawings of the lymph vessels of the human body might cover a Napoleonic plot in hieroglyphics. Antommarchi overcame their prejudices; before he left he was able to inform his colleagues in Florence that he had obtained permission to dedicate the preliminary volume of Mascagni to the Prince Regent of Great Britain and Ireland.[6] He reached St. Helena on September 20th, 1819—fourteen months after O'Meara had left—and was in charge of Napoleon—except for the occasions in which he was in disgrace—for a period of nineteen months. During that period the feverish attacks already described, except for an interval in the spring and summer of 1820, kept recurring with greater virulence, and as we now know, became intensified by the disturbances due to the onset of cancer.

No wonder Antommarchi has been misunderstood by distinguished writers like Lord Rosebery and M. Frémeaux! He belongs to a peculiar genus of humanity, the product of our research laboratories and of enthusiasm for science. Outside the laboratories those men seem unbalanced in their judgements and actions when measured by that conventional standard known as common sense. Inside the laboratories they are at home; their eyes are open and accurate then; their brains seek out puzzles which to the mind of the mere layman seem matters unworthy of attention. Napoleon knew the species of man Cardinal Fesch had sent him at once: "A kind of Cuvier," said the Emperor, "to whom he would give his horse for dissection, but not trust the cure of his own foot." In short, the Cardinal had selected the right man to work out the botany of St. Helena and to perform the autopsy on Napoleon, but altogether the wrong man to treat skilfully what in its event proved to be a most difficult, puzzling, and fatal case of illness. Those curious red spots which he saw on the intestine, as he carried out the final examination, were exactly the kind of thing which would arrest his attention; they were anomalous appearances which were at least worth keeping, perhaps worth investigation and explanation. They might confirm the diagnosis which O'Meara and he had made—namely, that the Emperor died of a disease endemic to St. Helena.

The question now remains to be answered: Could Antommarchi have abstracted such specimens unobserved either during or after the autopsy? M. Frémeaux answers very decidedly, No, it was impossible. Medical men will be less dogmatic in their answer. Centuries of a struggle to elucidate the problems of human disease against the obstacles raised by prejudice on the part of the public at large have compelled the best medical men to carry out the behests of science and human well-being by underhand and crafty means. I have known cases where great parts of the body were removed under the most strict surveillance. Antommarchi was an expert at annexation; he stole and smuggled out of St. Helena that fine death mask of Napoleon, which I

* Clause probably inserted by Antommarchi subsequent to the original draft of his report.

† Dr. Arnold Chaplin regards the widespread adhesions between the liver and diaphragm as the result of the ulceration of the stomach, the condition which he supposes preceded cancer. Such adhesions are always the result of an inflammation round the liver, and usually follow inflammation of the liver—never, so far as I know, an ulcer of the stomach. There was no adhesion of any part of the stomach to the diaphragm; the adhesion of the cancerous area of the stomach to the liver was not a strong one; when separated the peritoneal coat of the stomach was unbroken.

have no doubt we owe chiefly to the Irish surgeon, Burton, a cousin of the great Dublin physician Graves.[7] We know, however, that Antommarchi had the opportunity of obtaining such specimens as those at the College of Surgeons. The *post-mortem* examination began a little after 2 o'clock on the afternoon of the day following Napoleon's death; by 5.45 the examination was finished; Antommarchi had cut out the heart and the stomach (it would have been easy to take some parts of the bowel too—the English surgeons did not think them worthy of attention) and placed them in a silver vessel filled with spirits of wine. Does any one believe that the laymen and doctors stood by and watched until Antommarchi put the last stitch in Napoleon's final toilet? The atmosphere, the absence of water, the excitement at finding cancer, gave an opportunity to a man like Antommarchi, if he were inclined to use it. His friend, Dr. Arnott—Arnott always speaks of *Professor* Antommarchi—was placed on watch; M. Frémeaux states that Surgeon Rutledge was placed as custodian; no doubt Arnott and Rutledge relieved each other, for twenty-four hours elapsed between the time of the autopsy and the arrival of the four-fold coffin. During that period the silver vessel stood open to Antommarchi, who was "at home" at Longwood; the other surgeons were strangers there. When the coffin came Antommarchi was ordered—he was most reluctant—to place the heart and the stomach in the coffin. He prayed to be allowed to take them home with him. He took the stomach out and placed it in a silver sponge box removed from Napoleon's dressing-table; he left the heart in the original vessel, and makes the statement that he soldered down the lid of that vessel. That was the last opportunity Antommarchi had of retaining any of the relics he may have wished to carry away.

We have shown, then, that specimens of the kind now in the Museum of the Royal College of Surgeons were seen at the *post-mortem* examination of Napoleon and that the man who saw them had the opportunity and the will to obtain them. We must now follow Antommarchi's movements back to London. He left St. Helena on May 27th, 1821; by August 5th he was in London. O'Meara was there then; so was Sir Astley Cooper. The coronation of George IV was just over; Queen Charlotte lay on her death-bed—events in which both Cooper and O'Meara were interested. Like the rest of England they wanted to know the details of Napoleon's death. The first news of that event reached England on July 4th; on July 8th O'Meara wrote a letter to the *Morning Chronicle*, pointing out that the cause of Napoleon's death given in the official report must be received with reserve and scepticism; he drew attention to the fact that the official report was not signed by Antommarchi—the man best qualified to express an opinion had refused to sign the document; that the symptoms and history of Napoleon's case were incompatible with death from cancer; that the adhesions of the liver to surrounding parts indicated hepatitis and confirmed his diagnosis; that the official report of the *post-mortem* examination was, what we now know to be the truth—a political document. We have no record of the meeting of Antommarchi and O'Meara; we simply know they were both in London in August, 1821, but does any one doubt that those two men, who met so often two years before in the most friendly manner, who spoke a common language, whose reputations were at stake over the same case, would meet and see if they could retrieve their position and convince the public that they were right in their diagnosis and that the Hudson Lowe faction was in the wrong? It is likely that Antommarchi gave those relics of the examination at St. Helena to O'Meara as mere relics to be added to his Napoleonic collection, or it may have been with the view of having a final verdict as to their nature and their bearing on Napoleon's illness. They came, at least, from O'Meara to Sir Astley Cooper, and when the famous surgeon saw them he pronounced them cancerous growths, the very diagnosis which O'Meara, at least, wished to disprove. We have seen that Sir James Paget also regarded them as cancer, but did not substantiate his diagnosis by the more precise modern methods. And now, long years after, when all the actors are dead and gone, these specimens are submitted to modern and accurate methods and they prove to be not cancer but diseased lymphoid patches, probably manifestations of the infection of the body by one of those diseases which are still endemic to tropical or semi-tropical countries—a diagnosis which ought to give the disturbed ghosts of O'Meara and Antommarchi nights of blissful rest. Micro-organisms are still to be seen in the lymphoid plaques. Antommarchi, it may be added, returned to Italy, and led a life of continuous quarrel; then to Paris, where he tried to publish copies of Mascagni's plates as his own;[8] and then went abroad and died at Santiago in 1838, at the age of 49. Dr. Barry O'Meara, after marrying Captain Donellan's widow in 1823, died in the Edgware Road on June 3rd, 1836, at the age of 50, a result of attending one of O'Connell's (the Liberator) meetings.[9] At the sale of his effects the tooth (third molar) he extracted from Napoleon was sold for 7½ guineas; the tooth forceps then employed, 3 guineas; a lock of the Emperor's hair, £2 10s.* It will be thus seen O'Meara would naturally desire to add to his Napoleonic collection, and we may reasonably suppose one so much indebted to him as Antommarchi would like, if possible, to gratify his desire.

It will be seen that this narrative deals with two problems: (1) The history of two specimens in the Museum of the Royal College of Surgeons of England; (2) with the nature of Napoleon's illness during the last four and a half years of his life. The evidence which I have produced here has convinced me of the authenticity of the specimens. Such specimens were observed at the *post-mortem* examination; Antommarchi had opportunities of taking them; there were inducements for him to take them, and reasons why he should give them to O'Meara; we know O'Meara gave them to Sir Astley Cooper; we know that he was a keen collector of such specimens; we know they were transferred from Sir Astley Cooper's museum to their present abode.

The two specimens show a diseased enlargement of the lymphoid tissue of the bowel; we know that in his attacks, four and a half years before his death and probably two years before Napoleon became the subject of cancer, the lymphoid system of the body—the tonsils—the lymphatic glands became enlarged. Sir William Leishman informs me that all the symptoms manifested in the attacks of fever "are very similar to those of a chronic form of Malta fever, or, as we are now told to call it, undulant fever."

No one who has tabulated from the records left by O'Meara, Stokoe, and Antommarchi the symptoms manifested month after month by Napoleon during the first three years of his illness can doubt the recurrent febrile nature of his original disease. The symptoms are neither those of gastric ulcer nor gastric cancer, but of a nature which shows he suffered from a form of Malta fever, or of an infection nearly akin to Malta fever. The following letter from Sir William Leishman throws an important light on this point:

Royal Army Medical College
(University of London),
Grosvenor Road,
London, S.W.,
December 5th, 1912.

Dear Professor Keith,

What you tell me is extremely interesting. From the details you give I think it very probable that Napoleon must have suffered from a chronic form of Malta fever—or, as we are now told to call it, undulant fever. There is nothing in your account inconsistent with this; the recurrent febrile attacks with occasional jaundice and hepatic pain are well known in this disease, and a chronic hypertrophy of the lymphoid tissues is well marked in some cases, especially in connexion with the spleen, and various groups of lymphatic glands, such as the mesenteric, inguinal, axillary and others. My assistant, Major Kennedy, who was one of the Malta Fever Commission and had a considerable experience of *post mortems* on these cases, also tells me that Peyer's patches *are* frequently enlarged in chronic cases and sometimes even ulcerated, and this in cases in which enteric fever could be definitely excluded. Such cases also show at times distinct scorbutic symptoms and bleeding from the gums.

Malta fever was probably widespread over the Mediterranean long before it was identified as a clinical entity, but I cannot say anything about St. Helena, though I think if you were able to find that goats' milk was in use in the island in Napoleon's time, and especially if they imported Maltese goats as they did at Gibraltar and elsewhere, there would be a reasonable suspicion that he might have been reinfected there too.

Very truly yours,
W. B. LEISHMAN.

* I have been unable to trace the further histor of these relics. A description of Napoleon's third molar would be of interest.

Three years before Napoleon's death we may reasonably suppose that the inflammation of the liver which frequently appears in cases of fever endemic to tropical countries had brought about adhesions to the diaphragm and stomach. Hence it was impossible to feel any tumour in a stomach thus bound down beneath the liver. Skilled physicians like Hércau (1829)[5] and Boudouin (1901)[10] have supposed the great ulcer found in the stomach at death to have been caused not by cancer, but by inflammation. I do not think that their opinion can be upheld; it is altogether in opposition to the appearances and characters described by Antommarchi—the only account worthy of a moment's thought. Nor do I think that the view adopted by Dr. Chaplin—that the earlier symptoms were solely due to an ulcer of the stomach—can be accepted as a full and satisfactory explanation.

It is plain, then, that Napoleon suffered originally from an endemic fever in which the liver was severely affected, and that in the course of the illness cancer of the stomach—his father's ailment—supervened, but the symptoms of the superadded disease were entirely masked by the original disease. When that interpretation is applied, Napoleon's case becomes clear, definite, and understandable. It was a condition which might well have baffled and misled the most skilful physicians in Europe, until the terminal illness in the spring of 1821, when Dr. Arnott[11] alleges he began to suspect that the stomach was the seat of Napoleon's trouble. The discovery of cancer at the autopsy was a revelation to all; the Emperor alone anticipated the result. Poor O'Meara, Stokoe, and Antommarchi! Dismissed, court-martialled, and maligned by the laymen in authority and by modern lay writers because they did not solve a problem which only was capable of a full solution after death. In the main they were right in their diagnosis; most unfortunate in their treatment. It is an open question whether it was the fever or the cancer which actually killed Napoleon; the best that can be said is that, whether in St. Helena or out of it, cancer would have ended the career of the great Emperor.

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THE German Gynaecological Society will hold its fifteenth annual meeting at Halle in May (14th–17th). The principal subject proposed for discussion is the relation between diseases of the heart and kidneys as well as disturbances of internal secretion with pregnancy.

THE Department of Health of the city of New York has authorized the performance by its inspectors of anti-typhoid vaccination under conditions similar to those governing the free administration of diphtheria antitoxin. The vaccine will also be supplied free to medical practitioners for their own use.

THE January issue of the journal entitled *Concrete and Constructional Engineering* contains some striking statements with reference to the safety of various buildings in London in regard to fire. Seven years ago a very large number of buildings had been officially recognized as not meeting the requirements of the London County Council in regard to general construction, the provision of escapes, and other measures designed to diminish the annual number of deaths from fire. It is stated that there are now over 90,000 buildings within the metropolitan area which are officially "unsafe." Suggestions as to how the evil might be remedied without undue delay are also put forward in the journal in question. The other articles, though mainly technical, contain nevertheless a good deal that is of general interest. A subject worthy of discussion in its pages would seem to be the truth or otherwise of a popular impression to the effect that "fireproof" buildings burn up quite as quickly, or quite as effectually so far as destruction of life is concerned, as buildings which claim no such title.

# The Horace Dobell Lectures

ON

# INSECT PORTERS OF BACTERIAL INFECTIONS.

DELIVERED BEFORE THE ROYAL COLLEGE OF PHYSICIANS.

BY C. J. MARTIN, M.B., D.Sc., F.R.S.,

DIRECTOR OF THE LISTER INSTITUTE OF PREVENTIVE MEDICINE; PROFESSOR OF EXPERIMENTAL PATHOLOGY IN THE UNIVERSITY OF LONDON.

## LECTURE II.

### THE TRANSMISSION OF PLAGUE BY FLEAS.

MAY I remind you that bubonic plague is not an infectious disease? The patient is a negligible source of danger to his surroundings, provided he does not develop a secondary pneumonia. The reason is that, even if the excreta do contain some plague bacilli, there is no mechanism available to convey them into a second human being, as pest is not easily contracted by feeding. From an epidemiological point of view bubonic plague must be regarded as a disease of rats, in which, under suitable conditions, the infection spreads from rats to man.

It would be impossible for me to put before you this afternoon the mass of evidence for the above statements. I have already surveyed it in opening the discussion on the "Spread of Plague" at the meeting of the British Medical Association at Birmingham in 1911 (Martin, 1911), and, moreover, it is now well known.

It was difficult to explain how the bacillus was transferred to man from the rat, especially as man-to-man infection had been shown to be negligible. On epidemiological grounds, Ogata (1897), Simond (1898), and Ashburton Thompson (1900) came to the conclusion that the agent must be some form of insect, and for various reasons choice fell upon the flea.

You will naturally inquire why, if the flea is to be considered an agent of transmission from rat to man, does it not transmit from man to man? The answer is quite satisfactory, but I will, with your permission, postpone it until we have considered the case for carriage from rat to man.

If the blood of the animal contain a sufficiency of plague bacilli, some will obviously be taken in by a flea whilst feeding, and Ogata (1897) found that crushed fleas taken from a plague-infected rat produced the disease when injected into mice. This experiment was repeated with success by Simond (1898) and Tidswell (1900).

#### *The Mechanism by Means of which the Flea might Infect a Healthy Animal.**

The blood is sucked up from the wound made by the pricker. This structure is composed of three parts—the epipharynx and the two mandibles (Fig. 14). The apposition of the three forms a fine tube (Fig. 15), up which the blood is drawn, and passed down the gullet into the stomach by successive waves of contraction from before backwards of the muscles actuating the chitinous pharynx. The stomach is a pear-shaped organ occupying a considerable part of the abdomen of the insect. The internal economy of a flea and the arrangements of the mouth parts may be gleaned from the diagrams (Figs. 13, 14, and 15), which are borrowed from the Reports of the Commission.

The average capacity of a rat-flea's stomach was found by the Commission for the Investigation of Plague in India (Report, 1907, p. 397) to be 0.5 c.mm., and the number of bacilli in the blood of a plague-infected rat before death anything up to 100,000,000 bacilli per cubic centimetre. If, therefore, a rat-flea imbibed the blood of such a rat, it would receive into its stomach 5,000 germs.

* In dealing with the agency of fleas in the spread of plague I shall draw largely upon the work accomplished during the last few years by the Commission for the Investigation of Plague in India, with which I have had the honour to be associated. The Reports of the Commission have been published as special numbers of the *Journal of Hygiene*, 1906 to 1912.